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# Double Burden of Malnutrition Among Adolescents Studying in English Medium Private Schools in Tripura, India

**Biplab Jamatia***

*Associate Professor, School of Health Sciences, Indira Gandhi National Open University, New Delhi, India*

***Corresponding Author:** ***Biplab Jamatia,*** *Associate Professor, School of Health Sciences, Indira Gandhi National Open University, New Delhi, India.*

**Abstract:**

***Objectives****: The aims of this study were to investigate the prevalence of underweight, and overweight among adolescent students studying in class 9th to 11th standard in English medium private schools in Tripura, India.*

***Methods:*** *The cross-sectional descriptive study was carried out during November- December 2021 in four faith-based English medium private schools of Udaipur and Bishramganj subdivision of Tripura, India. Students aged 13 to 18 years were included in this study. Body mass index (BMI) was calculated using measured heights and weights. Demographic and other information were collected through questionnaires.*

***Results:*** *A total of 565 students participated in this study from four schools. The number of students participating from classes 9th, 10th, and 11th was 375 (66.4%), 85 (15%), and 105 (18.6%) respectively. The prevalence of severely underweight, underweight, normal weight, overweight, and obesity among the students was 12.9% [95% CI 10.4 – 15.9], 28.8% [95% CI 25.3 – 32.7], 48.3% [95% CI 44.2 – 52.4], 7.1% [95% CI 5.2 – 9.5] and 2.8% [95% CI 1.7 – 4.5] respectively.*

***Conclusion:*** *The present study revealed that adolescents in age between 13 to 18 years in the Udaipur and Bishramganj subdivisions of Tripura, India were suffering from a double burden of malnutrition. Less than half of the adolescents were having normal weight. A larger study may be required for further nutritional interventions.*

**Key Words:** *Adolescent; underweight, overweight, obesity.*

## 1. INTRODUCTION

Worldwide, disease profiles are transforming at a rapid pace catching the attention of medical professionals and policymakers alike. This is particularly true in low and middle-income countries that form the major chunk of the global population. The emerging epidemics of obesity, cardiovascular disease (CVD), and diabetes form the crux of this phenomenal change. Among these entities, obesity has become a colossal epidemic causing serious public health concerns and contributing to 2.6 million deaths worldwide every year. Obesity is an independent risk factor for CVD. Obesity is associated with an increased risk of morbidity and mortality as well as reduced life expectancy. The last two decades of the previous century have witnessed a dramatic increase in healthcare costs due to obesity and related issues among children and adolescents.[1]

A Comprehensive National Nutrition Survey (CNNS) was conducted by the Ministry of Health and Family Welfare (MoHFW), Government of India, UNICEF, and Population Council, and this survey suggested that there 26.4% were stunted, 4.1% were overweight and 0.8% were suffering due to double burden of diseases among the adolescent 10 – 19 years of age.[2] Obesity is one of the most widespread and major problems affecting children and adolescents and is a global nutritional concern. An increased prevalence is found in many countries where the major nutritional disorder previously was malnutrition.[3] Underweight, overweight, and obesity in childhood and adolescence are

associated with adverse health consequences throughout the life course.[4] In India, the emergence of childhood obesity presents a cause for concern because of recent changes in lifestyle and economic development.[5,6] The objective of this study is to find out the burden of malnutrition among adolescent students studying in class 9th to 11th standard in faith-based English medium private schools in Tripura, India.

## 2. Materials and Methods

A cross-sectional descriptive study was carried out during the months of November- December 2021 in four faith-based English medium private schools of Udaipur and Bishramganj subdivision of Tripura, India. The schools were selected based on the convenience of the researcher/investigator.

Out of the four selected schools, three were in rural areas whereas one was in an urban area.

Permission for conducting the study was obtained from the school authorities. Consent was obtained from individual students before administering the questionnaires. All the students of class 9th, 10th , and 11th standard of the selected schools were included in this study.

This study is a part of the original investigation where the investigator studied the Prevalence of alcohol intake and illegal drugs among students at English medium private schools in Tripura, India (North Eastern States of India). [7] The sample size was calculated based on the study conducted by Ningombam et al [8] for school students (The prevalence of alcohol intake was 29%). It was calculated as N = 4pq/r2 = 4p (1-p)/d2 = (4 × 29 × 71)/4 × 4 = 515, where p is the prevalence of alcohol intake (29%), q is the 1-p and d is precision (corresponding to effect size). The level of confidence usually aimed for is 95%, most researchers present their results with a 95% confidence interval (CI). and other details of methodology were used in this study.

Two teachers of each school were given training by the investigator to measure the height and weight of the students. The height and weight of all students in a particular school were measured by these two trained teachers. Height was measured by a stadiometer to the nearest centimeter without shoes with an error to the nearest of 0.1 cm, using standard procedures. Weight was measured with light clothing and without shoes with an electronic weighing scale to the nearest 100 grams.[9] Self-perception of health and weight was measured by the questionnaire developed by Long KNG et al.[10]

Demographic data were filled in by the students in the given form. Body mass index or BMI is a statistical index using a person's weight and height to provide an estimate of body fat in males and females of any age. It is calculated by taking a person's weight, in kilograms, divided by their height, in meters squared, or BMI = weight (in kg)/ height$^2$ (in m$^2$). The BMI number and classifications are listed below.[11]

- Severely underweight - BMI less than 16.5kg/m$^2$
- Underweight - BMI under 18.5 kg/m$^2$
- Normal weight - BMI greater than or equal to 18.5 to 24.9 kg/m$^2$
- Overweight – BMI greater than or equal to 25 to 29.9 kg/m$^2$
- Obesity – BMI greater than or equal to 30 kg/m$^2$

Data was entered and analyzed in the Epi info (version 7.2.5). The demographic profile, like, gender, place of residence, education, and occupation-like variables were described in percentage (frequency). The chi-square test was used to evaluate statistical significance, and a two-sided p-value of $< 0.05$ was considered as statistically significant.

## 3. Results

A total of 565 students who participated in this study were from four schools. The number of students participating from classes 9th, 10th, and 11th was 375 (66.4%), 85 (15%), and 105 (18.6%) respectively. There are 308 (54.5%) boys and 257 (45.5%) girls students. Most of the students belong to rural areas (92%) and only 8% of students belong to urban areas. The demographic profile of the study participants is described in table number 1. The mean age of the study participants was 15.5 $\pm$1.2 SD (minimum 13 years, maximum 18 Years).

**Table1.** *Demographic Profile of the Students*

| Variables | Number | Percentage | 95% CI |
|---|---|---|---|
| **Gender** | | | |
| Boys | 308 | 54.5% | 50.4 – 58.6% |
| Girls | 257 | 45.5% | 41.4 – 49.6% |
| **Residence** | | | |
| Rural | 520 | 92% | 89.5 - 94% |
| Urban | 45 | 8% | 6 – 10.5% |
| **Class** | | | |
| Class 9th | 375 | 66.4 % | 62.4 – 70.1% |
| Class 10th | 85 | 15% | 12.3 – 18.2% |
| Class 11th | 105 | 18.6% | 15.6 - 22% |
| **Age** | | | |
| 13 years | 6 | 1.1% | 0.5 – 2.3% |
| 14 years | 119 | 21.2% | 18 – 24.8%% |
| 15 years | 187 | 33.3% | 29.6 – 37.3% |
| 16 years | 125 | 22.3% | 19 – 25.9% |
| 17 years | 82 | 14.6% | 11.9 – 17.8% |
| 18 years | 42 | 7.5% | 5.4 – 10.7% |
| **Currently Staying** | | | |
| Hostel | 216 | 38.8% | 34.9 – 42.9% |
| With relative | 10 | 1.8% | 0.9 – 3.3% |
| Rented house | 171 | 30.7% | 27.1 – 34.7% |
| Own house | 159 | 28.6% | 25 – 32.5% |

The prevalence of severely underweight, underweight, normal weight, overweight and obesity among the students were 12.9% [95% CI 10.4 – 15.9], 28.8% [95% CI 25.3 – 32.7], 48.3% [95% CI 44.2 – 52.4], 7.1% [95% CI 5.2 – 9.5] and 2.8% [95% CI 1.7 – 4.5] respectively. Differences in the nutritional status among the students as per place of residence (rural and urban) and place of current stay were significantly different ($p < 0.002$).

**Table2.** *Nutritional Status of the adolescents*

| Item | Number | Percentage | 95% CI |
|---|---|---|---|
| **Severely underweight** | 73 | 12.9% | 10.4 – 15.9% |
| **Underweight** | 163 | 28.8% | 25.3 – 32.7% |
| **Normal weight** | 273 | 48.3% | 44.2 – 52.4% |
| **Overweight** | 40 | 7.1% | 5.2 – 9.5% |
| **Obesity** | 16 | 2.8% | 1.7 – 4.5% |

It was observed that around one-third of the adolescents were underweight. The prevalence of severely underweight was more among the students of the 9th class (13.9%), as compared to the students of class 10th (11.8%) and 11th (10.5%). The prevalence of overweight

was more among the students of class 11th (8.6%), as compared to the students of class 9th (7.2%) and class 10th (4.7%).

**Table3.** *Relationship of the Nutritional Status with other variables*

| Variables | Severely underweight | Underweight | Normal weight | Overweight | Obesity | P value |
|---|---|---|---|---|---|---|
| **Gender** | | | | | | |
| Boys | 36 (11.7%) | 94 (30.5%) | 140 (45.4%) | 28 (9.1%) | 10 (3.2%) | 0.14 |
| Girls | 37 (14.4%) | 69 (26.8%) | 133 (51.7%) | 12 (4.7%) | 6 (2.3%) | |
| **Class** | | | | | | |
| 9th Class | 52 (13.9%) | 101 (26.3%) | 183 (48.8%) | 27 (7.2%) | 12 (3.2%) | 0.74 |
| 10th Class | 10 (11.8%) | 29 (34.1%) | 39 (45.9%) | 4 (4.7%) | 3 (3.5%) | |
| 11th Class | 11 (10.5%) | 33 (31.4%) | 51 (48.6%) | 9 (8.6%) | 1 (0.9%) | |
| **Age** | | | | | | |
| 13 years | 3 (50%) | 0 | 3 (50%) | 0 | 0 | 0.08 |
| 14 years | 21 (17.6%) | 27 (22.7%) | 63 (52.9%) | 6 (5%) | 2 (1.7%) | |
| 15 years | 25 (13.4%) | 61 (32.6%) | 78 (41.7%) | 16 (8.6%) | 7 (3.7%) | |
| 16 years | 13 (10.4%) | 32 (25.6%) | 65 (52%) | 11 (8.8%) | 4 (3.2%) | |
| 17 years | 9 (10.9%) | 33 (40.2%) | 32 (39%) | 5 (6.1%) | 3 (3.6%) | |
| 18 years | 2 (4.8%) | 9 (21.4%) | 29 (69%) | 2 (4.8%) | 0 | |
| **Place of Residence** | | | | | | |
| Rural (n= 520) | 67 (12.9%) | 155 (29.8%) | 254 (48.8%) | 32 (6.1%) | 12 (2.3%) | 0.002 |
| Urban (n= 45) | 6 (13.3%) | 8 (17.8%) | 19 (42.2%) | 8 (17.8%) | 4 (8.9%) | |
| **Currently Staying** | | | | | | |
| Hostel (n= 216) | 19 (8.8%) | 66 (30.6%) | 122 (56.5%) | 6 (2.8%) | 3 (1.4%) | 0.0002 |
| Staying with relatives (n= 10) | 1 (10%) | 0 | 8 (80%) | 0 | 1 (10%) | |
| Rented house (n= 171) | 27 (15.8%) | 52 (30.4%) | 75 (43.8%) | 10 (5.8%) | 7 (4.1%) | |
| Own house (n= 159) | 25 (15.7%) | 42 (26.4%) | 65 (40.9%) | 22 (13.8%) | 5 (3.1%) | |

Girls students were more severely underweight (14.4%), as compared to the boys students (11.7%), However, boys' students were more underweight (30.5%) as compared to the girls' students (26.8%). It was observed that the prevalence of overweight and obesity was more among male students as compared to the girls students. The prevalence of undernourished (underweight and severely underweight) students was more among the students residing

in a rural areas, but the prevalence of the overnourished (overweight and obese) was more among the students residing in urban areas.

**Table4.** *Perception of their own health and weight*

| | Number | Percentage | 95% CI |
|---|---|---|---|
| **In General how is your health?** | | | |
| Excellent | 54 | 10% | 7.7 – 12.8% |
| Very good | 105 | 19.4% | 16.3 – 23% |
| Good | 339 | 62.8% | 58.6 – 66.7% |
| Fair | 27 | 5% | 3.5 – 7.2% |
| Poor | 15 | 2.8% | 1.7 – 4.5% |
| **How Do you describe your weight?** | | | |
| About the right weight | 181 | 45.4% | 40.5 - 50.3% |
| Slightly underweight | 122 | 30.6% | 26.3 – 35.3% |
| Very underweight | 30 | 7.5% | 5.3 – 10.5% |
| Slightly overweight | 41 | 10.3% | 7.7 – 13.4% |
| Very overweight | 25 | 6.3% | 4.3 – 9.1% |
| **Which of the following are you trying to do about your weight?** | | | |
| Gain weight | 90 | 17.6% | 14.5 – 21.1% |
| I am not trying to do anything about my weight | 149 | 29.1% | 25.3 – 33.2% |
| Lose weight | 119 | 23.2% | 19.8 – 27.1% |
| Stay the same | 154 | 30.1% | 26.3 – 34.2% |

It was observed that 10% (95% CI 7.7 – 12.8%), 19.4% (95% CI 16.3 – 23%), and 62.8% (58.6 – 66.7%) of adolescents perceived that they have excellent, very good, and good health respectively. 30.6% (95% CI 26.3 – 35.3%) and 7.5% (95% CI 5.3 – 10.5%) adolescents perceived that they were slightly underweight and very underweight respectively. 10.3% (95% CI 7.7 – 13.4%) and 6.3% (95% CI 5.3 – 10.5%) adolescents perceived that they were slightly overweight and very overweight respectively. 17.1% (95% CI 14.5 – 21.1%) of adolescents think that they need to gain more weight. However, 23.2% (95% CI 19.8 – 27.1%) of adolescents think that they need to lose more weight.

## 4. DISCUSSION

This study observed 41.7% of the adolescent students were underweight. This prevalence of underweight among adolescents was close to the national prevalence observed by the National Family Health Survey (NFHS), although the prevalence of thinness in boys and girls has decreased from 58.1% and 46.8% in NFHS-3 to 45% and 42% in NFHS-4 respectively. Still, it is a challenging issue for a developing country like India.[10] Similar prevalence of undernutrition among 10–15-year-old rural school children in Paschim Medinipur and Puruliya district of West Bengal was 44.54% as reported by Bose K et al.[12]

However, this prevalence of underweight is much more as compared to the study conducted by Thakur et al in the central Indian city (Sagar), where it was found that 6.3% of boys (aged 5 – 18 years) were stunted, 4.3% were underweight and 3% were undernourished.[13] The Global School-Based Student Health Survey also reported that around 4% of girls aged 13–15 years were underweight; although more than 10% of surveyed girls were underweight in Mauritius, Sudan, Bangladesh, Maldives, Cambodia, and Vietnam.[14]

The reason for undernutrition may not be a shortage of food. It is because, 29.2% of the underweight adolescents were trying to

maintain their current weight, 36.7% of the underweight adolescents perceived that they have normal body weight and 8.6% of the underweight adolescents were trying to lose their weight. Chugh R et al also reported that 88% of the normal-weight and 32% of the underweight adolescent girls in the age group of 16–18 years attending a leading public school in Delhi wanted to lose weight. [15] Fortunately 32.1% of the underweight adolescent students were trying to gain weight. Further, 26.4% of the normal-weight adolescents were trying to lose their weight.

The current study reported that 7.1% and 2.8% of adolescent students were overweight and obese respectively. Laxmaiah A et al also found the overall prevalence of overweight and obese among 12 to 17 years, urban adolescents, in Hyderabad, India were 7.2% and 1.3% respectively.[16] Prevalence of obesity, and overweight among adolescent school children in the east district of Sikkim, India was 2.04%, and 14.5% respectively.[17] A study was conducted among the students of classes from 5th standard to 12th standard in North East India and the prevalence of overweight and obese girls was 9.76% and 1.22%. Among boys, it was 10.97% and 3.23%, respectively.[18] However, the overall prevalence of overweight and obesity in affluent adolescents in Surat City, South Gujarat Region, India was higher and it was reported to be 13.9% and 6.55% respectively.[19] The prevalence of overweight and obesity in upper socioeconomic status (USES) in School Children ( 5 – 17 years) from Delhi was 16.75% and 5.59% in boys, and 19.01% and 5.03% in girls respectively.[20] The reason for the higher prevalence of overweight and obesity among the adolescent population studied in Delhi and Surat city might be that the subjects selected for these studies were affluent. It was also reported that 19.5% of overweight adolescents perceived that they have normal body weight. Unfortunately, 3.8% of overweight adolescents were trying to gain more weight. 66% of the overweight adolescents were trying to lose weight but 8.4% of the normal-weight adolescents were trying to gain weight.

It may be noted that adolescents belonging to different economic groups can only afford the cost of English medium private school and those who cannot afford the cost of the school went to the government or other types of schools. This issue may be a limitation of this study.

## 5. Conclusion

The burden of double malnutrition among adolescents was alarming. Less than half of the adolescents were having normal body weights. The prevalence of the double burden of malnutrition at the population level among schooled adolescents living in Tripura, India is a nutritional problem of public health importance. This study highlights the urgent need for a larger study including all government and private schools to address the double burden of malnutrition. It may be useful for planning nutritional interventions.

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